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FLORA OF THE GREAT SMOKIES[1]

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There is not much left of America as it was when white man took possession and more's the pity; but a fair sized piece of it remains pretty much as was in the beginning in the 440,000 acre Great Smoky

Fig. 1. Mt. LeConte (Thar's flora in them thar hills).

Mountains National Park. Phantom clouds and rising mists give name to the region, but after all the variety and abundance of plant life is one of the outstanding features of the area. For persons interested in making pictures, the whole region is a sheer delight.

In this sketch, Flora is being treated in the broadest sense of the word. Thus the reader will find a little about the more conspicuous

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elements of the mountain vegetation from the slime-molds to the sunflowers—but the *wildflowers and the trees receive a well deserved and most extended treatment.*

The area of central interest is the Great Smoky Mountains National Park, an area where the vegetational aspects are superlative in every sense of the word. The pile of rocks which form the backbone of this region would not be impressive were it not for the far-flung forest mantle with its carpeted floor, decorated as it is with showy flowering shrubs, and an almost endless variety of wild flowers, ferns, mosses, and fungous forms.

Fig. 2. Foam Flower (*Tiarella cordifolia*) at home.

There are few places of comparable area in the north temperate zone where as many different kinds of plants flourish. From early spring to late fall the floral calendar is full. Amateurs as well as professionals are finding the region particularly enticing because it is one in which many new and some rare or otherwise unusual plants have gone native. Evidently the botanical exploration of eastern North America is not as yet completed! At any rate several "new species" of plants have been discovered in the Great Smokies Park during the past few years. Someone—probably the late Mr. Horace Kephart—has reported on the north-and-south-root plant, a form described as being peculiar to the Great Smoky Mountains and which

only the native mountain folk have ever seen. As I recall it the north-and-south-root plant grows about waist high, has "sorter heart-shaped leaves" and occurs only in the deep shady coves well back in the mountains. If the leaves and soil are carefully removed, the roots thus exposed are discovered to be "squar with the world and pintin straight north and south." The mountain man admits: "You'uns don't believe it, but hits so." But, scientifically speaking, new kinds as well as truly rare ones may be found here; kinds that have not been described in scientific literature.

Once-upon-a-time virgin forests covered practically the whole of this region. To be sure considerable timber has been cut, but within

Fig. 3. Fungi abound! Oyster Mushroom (*Pleurotus sapidus*).

the confines of the Park this practice is now a thing of the past and, besides, the fact remains that within the Park's boundary there is upwards of 200,000 acres of virgin hardwood forest. It is believed that the progenitors of our present-day hardwood forest were evolved upon the mountains of Appalachia—mountains whose antiquity is estimated in eons. A "wilderness area" comprising nearly 15,000 contiguous acres has been set aside within the confines of the Park. Excepting the Appalachian Trail which traverses the top of the high divide or "state line" this tract is just about as it was in the beginning and will be left lying outdoors in its original unim-

proved condition. Here one may find Nature, and Solitude; a great variety of plants and a considerable number of animals, including bear. The area is pretty well off the beaten trial but of reasonable accessibility. A number of little footpaths penetrate the very depths of this preserve, but some of it may never be seen, or even heard of except by those possessed of a strong mind, robust limbs, and a stout heart.

Something like 25,000 acres of spruce and fir comprise a black forest of unmatched charm, covering the high mountain tops like a mantle, and extending from points a little bit west of Clingman's Dome to near the eastern end of the Park. Only a scattered few specimens of the spruce occur at elevations below 4,500 feet, and the balsam-fir is quite infrequent below 5,000 feet. This very southern spruce-fir forest, I think, constitutes one of the most valuable of the Park's (natural) assets. At any rate this forest is worth more for recreational purposes than it is for lumber.

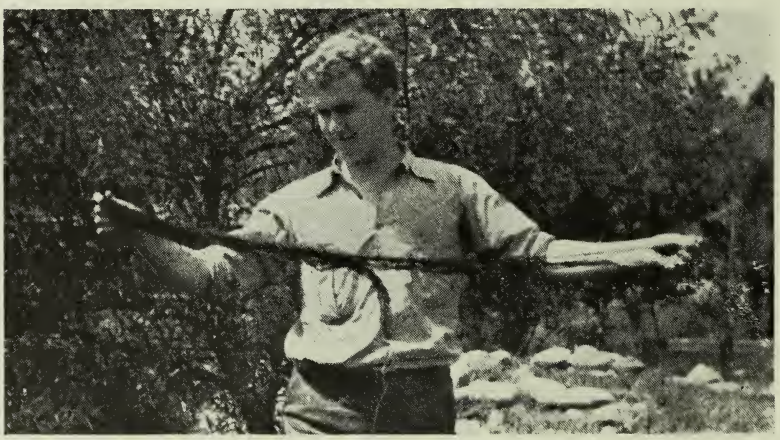

Fig. 4. The hank in Mr. Sharp's hands is a moss (*Fontinalis* sp.).

But the amount of forest as a whole is no more remarkable than the variety of its composition. One hundred and forty-seven different species of trees have been discovered growing within the Park boundaries. To be sure some twenty of them are exotic to the region; others included are "shrubs" become aborescent in the well watered, fertile soils of favorable habitats. Of the total number about 100 species may very well be denoted as forest trees, that is plants of a size and a quality sufficient to make them more or less valuable sources of lumber. In all Europe there are some 85 tree species.

An even greater number of different kinds of shrubs and vines thrive in these environs. Here, in the Great Smokies, Rhododendrons and the Mountain Laurel are at their best, "he's boss" the native

folk would say. Of all the flowering shrubs, the Azaleas seem to be the most abundant and perhaps the most characteristic of the Park's

Fig. 5. Fiddle heads and fertile fronds of the Cinnamon Fern (*Osmunda cinnamomea*).

cherished possessions. With all it would seem that this region is truly one of Nature's finest arboretums.

Buckley the botanist and Guyot the geologist "discovered" this

Eden for us along about 1856. The latter's name and fame is commemorated by the second highest of Smoky's peaks; the former by Mount Buckley and the rare shrub *Buckleya distichophylla* (not presently known to occur in the Park, though some cuttings of it were planted near the old Cherokee orchard—to LeConte trail between one and two miles below Rainbow Falls about the year 1930). Earlier still (1787) the famous French botanist, André Micheaux, went to Mount Michell on one of his collecting excursions, but there

Fig. 6. Twins—In this case, the cones of *Pinus pungens.*

is no record of his having penetrated the fastnesses of the Great Smoky Mountains. William Bartram of Philadelphia, famed for his writings of early day travels and botanical interests, came into the Cherokee country about the year 1776, but we have no positive records of his having visited and collected in the Great Smokies area, which in those days was relatively one of the most remote places in eastern North America.

Under the trees on mountain and mead, in rocky glades and in open leas grow a great abundance and a remarkable variety of plants. During the spring and early summer months, the area of particular interest to us becomes a series of extensive wild flower gardens. More often than not the species represented are infrequent elsewhere. Vast beds of the Mountain Phacelia carpet acres of woodland glade in early spring, nowhere better seen than along the truck-

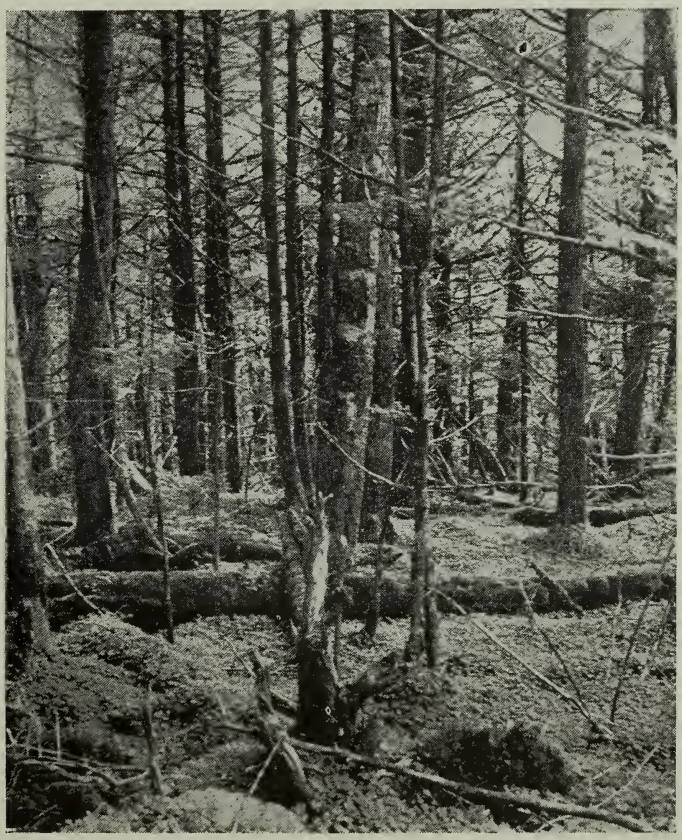

Fig. 7. No Mosses—No Spruces; No Spruces—No Mosses.

trail about seven miles above Elkmont, and in similar habitats in the lower parts of Porter's Flats. Two weeks to a month later this species blooms in open coves in the vicinity of New Found Gap. At or near the same places Sugar Knabs (*Trillium grandiflorum*) and Creeping Phlox are usually found in great profusion. The latter, a delicate lavender bloom, often forms extensive beds in the rich, moist soil along water courses and in fertile woodland glades. Mats

of the Mountain Bluet, blue as the sky, occur on many of the wooded slopes, and later, one will find little coves filled to overflowing with the Mountain Golden Glow, sometimes in company with the big red-headed Beebalm, also known as Oswego-tea. In late July the little "Parks" along the Appalachian trail west of Clingman's Dome be-

Fig. 8. Mountain Laurel, Spoonwood, Ivy (*Kalmia latifolia*).

come almost filled with six to eight foot Lilies Royal (*Lilium superbum*).

The Azaleas come early and stay late (May 1 to September 1), but may be seen best to advantage at higher elevations; Gregory's Bald, for instance, during the last half of June. The Service tree (*Amelan-*

chier laevis) is one of the earliest to bloom. A little later its place seems literally to be taken by the Silver-bell (*Halesia carolina*) to such an extent that a distant slope will appear as though it had nothing but this species growing on it. A few weeks later the silver bell has disappeared it seems, only to be replaced by Basswood trees, and so it goes on through the summer and into the winter.

Fig. 9. Galax (*Galax aphylla*).

From about the middle of October to the middle of November is the best time to see the fall-color display on and around the Big Smokies.

Frost is only one of several environmental factors which make for a fine exhibit, although of course it is an important one. Wind and rainfall greatly affect the brilliance and duration of the picture as a whole. The brightest colors come first and are more varied, if

favorable growing conditions prevail at the time when the first sharp frosts come. Rainfall and wind coming soon after the leaves have turned and are brighest, quickly defoliate the yellow poplars and certain other species. However, one may count on a remarkable and varicolored show here in season—year in and year out.

The 1936 display was not, in my judgment, quite the equal of 1935; seemingly because the best of growing conditions did not

Fig. 10. Angels' Delight—(*Trillium erectum* var. *blandum*).

pertain throughout the summer. Then, too, frosty weather was late in arriving that year (October 30) whereas, in 1935, we had sharp frosts early in October (6, 7, and 8).

In late November and early December the only plant in bloom hereabouts is the Witch-hazel (*Hamamelis virginiana*). Its flowers persist well along into the winter. The fact that its flowers open and

bloom in late fall, or early winter, is quite sufficient to account for the English name "Witch-hazel."

The fruits and seeds of many plants are still in evidence, and furnish abundant food for birds and certain other animals. High up in the oaks, sycamores and other deciduous trees, the American Mistletoe (*Phorodendron flavescens*), may be seen silhouetted against

Fig. 11. Ladies Tresses—(*Spiranthes cernuua*).

early winter skies. The form and parasitic habit of growth of this species gave rise to many a medieval suspicion, some of which survive to this day to effect its use at Christmas time. At a distance, specimens of it considerably resemble large birds' nests. Its small white berries, hardly discernible from the ground, are evidently palatable to certain birds, and when other food is gone or covered by winter snows, the energy-packed fruits of the Mistletoe are available to high flyers—as long as the supply lasts. Parasite though it is, the

Mistletoe has been considerably exploited to supply the demand for Christmas greens. Like many another natural resource having commercial value, its conservation in our Parks is as much a function of the Service as anything else.

By December 1, the fruits of the American Holly (*Ilex opaca*) have become red, if not ripe. Before the end of the month they are full-sized and matured, but the fruits are not visible at any great

Fig. 12. Umbrella Leaf—(*Diphyllea cymosa*).

distance because of the size and position of the evergreen leaves. However, the berries persist well nigh all winter if not taken by hungry birds and other denizens of the woodland.

"Our feathered friends" are very much less in evidence now, nearly all except winter residents having migrated. Turkey and grouse "signs" are seen less often during December than in October, but they are still with us.

On clear days landscapes, both near and far away, are different, but equally as impressive as in other seasons. The "soft" warm colors which prevail at middle elevations are of peculiar and lasting charm. All in all, there are innumerable items of inviting and worth-while interest, not the least of which are the Mosses and Liverworts, which "show up" to the very best advantage during the late fall and winter months. Also, the number of herbs, as well as trees and shrubs in this Park which are evergreen, is strikingly large.

But winter is not without its occasional spectacle, when following a period of stormy weather the same spruce and fir trees that compose our black-forest become an extensive Christmas-tree park with all the trees covered with ice crystals which sparkle like diamonds in the bright sunlight; the whole making a never-to-be-forgotten sight.

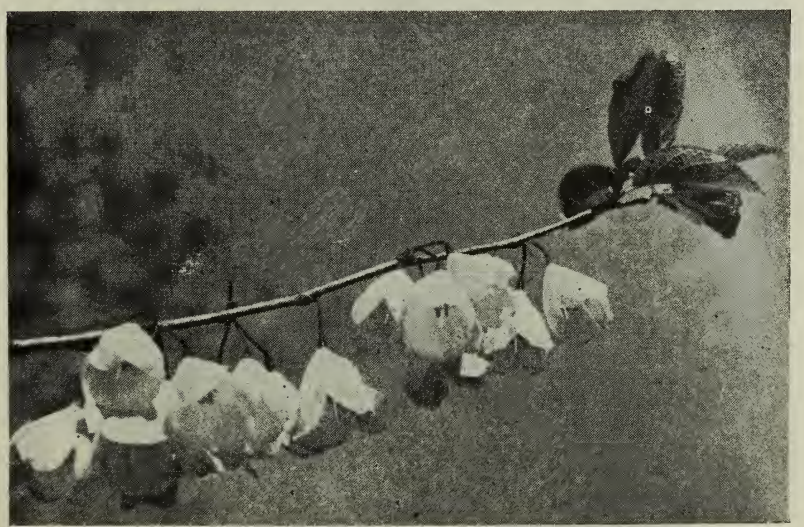

Fig. 13. The beautiful, but silent Silver Bells of *Halesia carolina.*

One of the outstanding advantages here available is—opportunity to study seasonal succession in the flora, without having to wait all summer. Beginning at the base of a mountain on a warm day in May, one soon leaves behind a flora characteristic of early summer. As he plods upward, along the steep winding trail, the seasons appear to be arranged in reverse order. As gradually he gains altitude, spring is coming again, it seems. Plants that were found in full bloom, or even in fruit below are now noticed in vernal condition. Later, upon gaining the top, at an altitude of about five thousand feet, the beeches and oaks which were found in full leaf and bearing fruits at the mountain's base are at this altitude most noticeable because of the absence of leaves. It is early spring here, and the winter

buds on the trees are only beginning to open. The few flowers found blooming near the mountain's top are like the harbingers of spring, seen a month or two earlier down in the valleys below.

In half a day's hike one can climb from the river's valley to the top of some of the loftiest peaks, gaining about five thousand feet in altitude. In so doing he will pass in succession the same life zones he would meet traveling northward from the latitude of southern Tennessee to the northern reaches of the Adirondacks, or southeastern

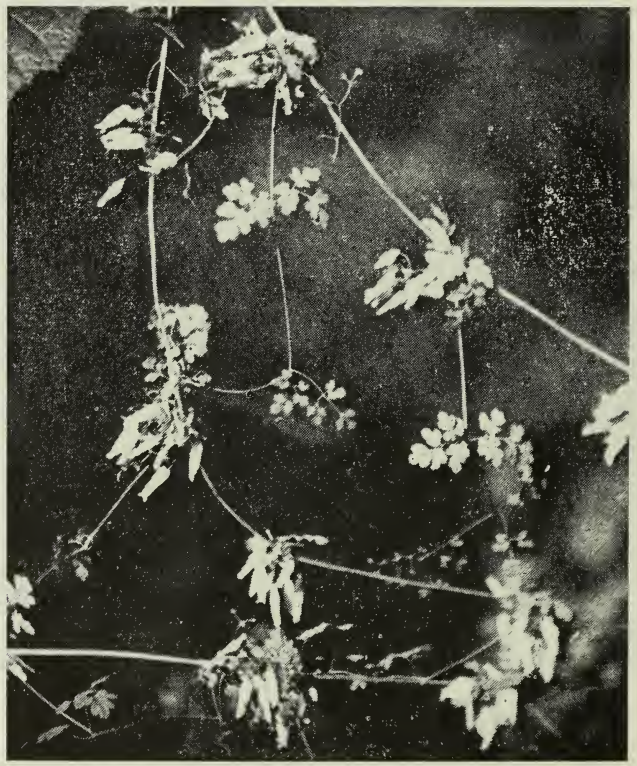

Fig. 14. The Climbing-Fumatory or Allegheny-Vine (*Adlumia fungosa*) is rather frequently found draped over boulders and rock piles.

Canada. In the creek bottoms and river valleys of the foothills, one finds himself amidst vegetation characterized by the presence of Sycamore, Yellow Poplar, Gum, Oak, Elm, Persimmon, Flowering Dogwood, Redbud, and the like. In the spring and early summer months, at altitudes up to a mile above sea-level, and more, violets of many kinds are abundant and bloom profusely, and several species of huckleberry are common. The Fetter-bush (*Leucothoë Catesbaei*) of uncertain fragrance, but with showy, pointed, green leaves is quite de-

serving of the local name of "dog-hobble." On dry hillsides in out-of-the-way places, the Trailing Arbutus, or "Easter Flower," as the mountain-man calls it, may be found. One of the super-sights of the vernal season is furnished by the Flowering Dogwood and the Redbud, whose white and pink glorify the landscape over large reaches of unimproved lands. A little later roses bloom in profusion, and are succeeded by such striking things as The Trumpet-creeper and a bright-colored milkweed called the "butterfly weed" (*Asclepias tuberosa*). Grape vines of all ages and sizes clamber among the shrubs and trees. Not infrequently the older ones are sufficiently large and stout to provide swings for the country children. Less conspicuous, but none the less common, is a species of Ginger-root, whose stemless plants bear large heart-shaped or kidney-shaped leaves that effectively

Fig. 15. Staminate flowers (catkins) of the American Chestnut (*Castanea americana*) are quite easy to look at but not pleasant to smell.

conceal short-stemmed, jug-shaped flowers. Species of wild onions are all too common to suit most farmers, and they are really difficult to eradicate, but one kind is much sought after by the mountain folk, who call it "ramps," and gather and eat its bulb with great relish. Ginseng is indigenous throughout the Appalachians, but except for cultivated patches, it is rare, and only the knowing "sang" hunters succeed in finding enough nowadays to make it worth going after. Scores of other "yarbs," some of known value, like the bloodroot, the wild ginger-root, and the aconite are native in the Park. Formerly when times were hard these plants were extensively gathered and sold. Nearly everywhere in the woods, the handsome, shining green leaves of Galax attract the eye.

Of the several species of Rhododendrom native to the region, the Great Laurel (*R. maximum*) undoubtedly enjoys a wider local dis-

tribution than any of the others, but it is rare except in the Appalachians. It grows in damp, deep woods everywhere in the Smokies, at middle elevations. Commonly a shrub, this variable species sometimes attains tree-like dimensions and a height of about thirty feet. The creeks and rivers are characteristically boardered with heavy

Fig. 16. View to the east from the "Gant Lot" near Gregory's Bald. The abundance of the bloom of the American Chestnut trees makes for the grayish appearance of the slope in the middle ground (Photographed July 12, 1935).

masses of this Rhododendron, whose shining green leaves "trail the current." The Mountain Rose-bay, or Catawba Rhododendron, occupies a less extensive range geographically. It will thrive at altitudes

well under one thousand feet, where soil conditions and culture are favorable, but in its native heath, it is most commonly seen at elevations from 3,500 to 5,500 feet. Sometimes it is found growing in the woods, but it is most at home on high ridges and mountain spurs where its roots find footing and nutrients in loose friable humus between the rocks. Words cannot describe the Mountain Rose-bay when it is in bloom! Its large, lilac-purple flowers, produced in great

Fig. 17. Dangling panicle of Fetter-Bush flowers (*Leucothoe Catesbaei*). Flowers of uncertain fragrance.

profusion, seem to attract shafts of sunlight from above, and the handsome broad evergreen leaves reflect it in all directions, signalling the passerby to look upon a sight never to be forgotten.

Throughout the middle-life zones, the Flame Azalea grows and blooms in May and June, depending upon the altitude at which it is found. William Bartram, of Philadelphia, called it the "Fiery Azalea," and reckoned as one of his finds "this most celebrated species of Azalea." The flowers he described as being "in general

the color of the finest red-lead, orange and bright gold, as well as yellow and cream-coloured. These various splendid colours are not only on separate plants, but frequently all of the varieties and colours can be seen on separate branches of the same plant; and the clusters of blossoms cover the shrub in such incredible profusion on the hillsides that suddenly opening to view from the dark shades we are alarmed with apprehension of the woods being set on fire. This is certainly the most gay and brilliant flowering shrub yet known."

Along the way up the mountain are giant buckeyes, hickories, yellow poplars, birches, hemlocks, and other trees less striking and less

Fig. 18. *INVITING YOU!* The Bull-head Trail—to Mt. LeConte.

common. I have been told that the old-time mountaineers used buckeye seeds to make their liquor foam. Just what advantage a foaming "mountain dew" has was not told. The rare *Cladrastis,* or yellowwood tree, may be found by the traveler who gets away from the beaten trail. I have been told that Noah built the Ark with timber from this tree! Anyhow, the plants bloom in late May or early June and its beautiful dangling panicles of white flowers exhale a fragrance fit for use as an incense at the shrine of the sylvan dieties.

Higher up, especially along paths that trail a creek, extensive stands of spruce, as in the north country, encourage the climber; the mountain top is only a half mile on—and nearly as far above! Dwarfed specimens of beech, oak, birch, and chestnut persist to altitudes above 5,000 feet, where they are replaced by cherry, mountain ash, balsam,

and red spruce. Here in this "canadian" zone at or near the tops of the higher mountains ferns are common, but less abundant than on the mountain slopes below. Among the mosses under the spruce trees the Balsam-bell (*Clintonia Borealis*), indigeneous also in the cool moist woods of northern New York and southern Canada, makes a striking display with its broad basal leaves and three-parted flowers. In June the Alleghany Myrtle blooms profusely at the very crest of the mountains and on the rock cliffs which face south and east. Associated with it is the Mountain Rose-bay, and sometimes the Carolina Rhododendron.

Fig. 19. Bouquet of Flame Azalea flowers (*Rhododendron calendulaceum*). "The most gay and brilliant shrub yet known"—*Wm. Bartram.*

Obviously plant life occupies a conspicuous part in the wildlife picture in the Great Smokies. Truly the conservation of our native plants has reached the critical stage. Further exploitation or even disregard of wildlife values (plants included) is fraught with significant menace to human kind. Hence it behooves us to learn more and more—rather than less and less—about the subjects under discussion. The interest of the general public has never been greater than it is today, and only financial support is necessary to make positions available to increasing numbers of young men and women who are in need of work, and are prepared to contribute to our knowledge of plants and conservation.

Flowering Plants
SPERMATOPHYTA

The seed-bearing plants comprise the most important and certainly a very popular part of the flora of the Great Smoky Mountains National Park. Their collection and study, began by Buckley and Rugel, has continued ever since and, under the auspices of the National Park Service, it has been one of our most important projects. In

Fig. 20. Elf-Feather. Solomon's Plume (*Maianthemum canadensis*).

season, since 1934, we have collected and prepared (duplicate) herbarium specimens of about 5,000 numbers. Nearly 1,500 different species are represented in these collections. (In Small's *Manual of the Flora of the Southeastern States*, 5,555 species are described.) Undoubtedly there are more to be found because there are large areas within the confines of the Park which have not been explored botanically, and there are many habitats which have not been explored at all. To guess at the total number of species of higher plants oc-

curring in this region is hardly worth while, but without doubt new things will continue to turn up, particularly when specialists in one or another of the several groups make extensive and intensive exploration.

In 1936 some 120 different species of trees were reliably reported as occurring in the Park. Since that time 27 more have been added to the list, bringing the total to 147. Possibly one or two of the number should be excluded from the list, but it is also possible that another one or two should be added—in fact or by interpretation.

The forests of the Park constitute an outstanding feature of the vegetative cover. The spruce-fir forest which clothes the peaks and high slopes of the mountains in well over half our area is characteristic of the Hudsonian life zone in this country. Not infrequently the

Fig. 21. Trailing-Arbutus (*Epigaea repens*).

Mountain Ash (*Sorbus americana*) occurs in this association. It is believed that somewhat more than half of the remaining acreage of this forest-type is found within the confines of this Park, where it is safe from the exploiting lumberman. The American Beech (*Fagus grandifolia*) reaches all but the high summits, as do the following: Yellow Birch (*Betula lutea*), the Chestnut (*Castanea dentata*), Mountain Red Oak (*Quercus borealis maxima*), the Chestnut Oak (*Quercus montana*), Scarlet Oak (*Quercus coccinea*), the Mountain Maple (*Acer spicatum*), Yellow Buckeye (*Aesculus octandra*), and the Wild Black Cherry (*Prunus serotina*). Extremely large specimens of these and other tree species are to be found in the Great Smokies. Tulip poplars five to seven feet in diameter are not infrequent and at least one has been reported as having a diameter-breast-high measurement of nearly nine feet. Giant oaks are fairly common, as are also

Buckeye and Maple trees. A Cucumber-tree having a trunk five feet in diameter stands besides the trail on the Kalanu Branch in the Greenbrier district. The "cherry-orchard" in the valley of Ramsey Prong contains many exceptionally large specimens, some having trunks three to four feet in diameter and about fifty in length. Along Meig's Creek there are several very large American Holly trees, at least one of which has a trunk diameter of about thirty inches. Recently a

Fig. 22. Goats-Beard (*Aruncus Sylvester*).

Mountain Laurel (*Kalmia latifolia*) of aborescent dimensions was brought to light. The buttress measured eighty-two inches in diameter; to the best of our information this plant is a record for size and age of its kind.

Five different species of pines grow in the mountains. Probably no finer stands of the native Hemlock (*Tsuga canadensis*) can be

found today than occur in the moist fertile coves of the Great Smokies. In the same or similar habitats "cove hardwoods" dominate the vegetative cover and such species as the Tulip-poplar (*Liriodendron tulipifera*), Sugar Maple (*Acer saccharum*), Silver-bell (*Halesia carolina*) occur. Several varieties of Basswood (*Tilia* sp.) occur in the hardwood forests of the mountains of the Park, also the Southern Red Oak (*Quercus rubra*), Chestnut Oak (*Quercus montana*), four species of Hickory (*Hicoria* sp.), Black Locust (*Robinia pseudo-*

Fig. 23. American Shield Fern (*Dryopteris americana*). Photograph by Jesse M. Shaver.

acacia), Honey Locust (*Gleditsia triacanthos*), four species of Elm (*Ulmus* sp.), three species of Magnolia, Sugar Berry (*Celtis occidentalis*), and the Sycamore (*Platanus occidentalis*); to mention some of the outstanding tree species which compose the hardwood forests of the mountains of the Park. At least one more—the Yellowwood (*Cladrastis lutea*)—should be mentioned because of its outstanding beauty and comparative rarity. Its pendulous racemes of white flowers are beautiful in themselves, but, as though this were not enough, they exhale a spicy fragrance that attracts man as well as bees.

Even though its wood does not make particularly valuable lumber, "it was extensively used by Noah in building the Ark."

Some of the showiest elements of our flora are shrubs. In the Great Smokies (and elsewhere) they compose an understory "forest" of striking abundance in many places, or, in other cases, the chief vegetative cover on exposed ridges. The brilliant and beautiful Flame Azalea (*Rhododendron calendulaceum*), long since publicized by

Fig. 24. Bouquets of the justly popular Mountain Rosebay, or Catawba Rhododendron (*Rhododendron catawbiense*).

Bartram's inimitable description, is abundant in the mountain flora. Other Azaleas merit attention, *e.g.*, *Rhododendron arborescens*, denisen of rocky river banks, having fragrant white flowers; the Pinxter Flower (*Rhododendron nudiflora*), earliest of them all, having pretty pink flowers which come before the leaves; the Mountain Laurel

(*Kalmia latifolia*), equally as beautiful as any of our flowering shrubs. The masses of bowl-shaped flowers, each with ten trick stamens, are especially worthy and attractive. Equally famous and showy is the Catawba Rhododendron (*Rhododendron catawbiense*), whose beautiful flowers and equally beautiful leaves attract visitors who reach elevations above 3,000 feet. Other kinds of Heath Family plants too numerous to list completely are justly famous components of the flora of the Park. A few outstanding kinds include: the Fetter-bush

Fig. 25. Here's looking at you (*Trillium erectum* var. *album*).

(*Leucothoë Catesbaei*), with its small wand-like branches and suspended flowers of uncertain fragrance; also the Alleghany Myrtle (*Leiophyllum Lyoni*), beautiful but rugged inhabitant of exposed situations on cliffs at high elevations; and the less conspicuous Mountain Cranberry (*Vaccinium erythrocarpum*).

But herbaceous wildflowers compose some of the choicest gems of the Great Smoky Mountains—where the ground in wood and field is carpeted with them in season. Several species of Phlox occur in as

many habitats during the spring and summer, and upwards of 25 kinds of violets bloom in this region. *Viola septentrionalis,* denison of the northland was discovered here in 1936.

Among the choicest of all wildflowers is the Trailing Arbutus (*Epigea repens*), and it is really quite common in sandy soil on partly shaded slopes. Its beauty and fragrance seem almost to charm one into taking specimens, but it is practically impossible to bring it under cultivation from the wild, and its collection is fraught with so much destruction that it should be left undisturbed. On the other hand,

Fig. 26. The Pink Ladys-slipper (*Cypripedium acaule*).

Phacelia bipinnatifida of repellent odor, but having beautiful and abundant lavender flowers can be found in beds of sufficient size to warrant taking a specimen to transplant. It were just as well, however, to collect and plant its seeds if a garden bed is desired.

A number (8) of kinds of Trillium are native in the Park, where they are commonest in the woodlands. The Painted Trillium (*Trillium undulatum*) may be seen to good advantage in the mountains, where it grows rooted in acid humus at elevations from 2,000 to 5,000 feet. Vasey's Trillium (*Trillium Vaseyi*) enjoys a lesser

range and less acid soils. It is rarer than the Painted Trillium with us, and its large maroon-colored flowers make it very attractive indeed. Of even greater range and abundance than any of the others named is Stinking Willie (*Trillium erectum,* var. *album*). The true species has maroon or brown-purple petals, but the commonest form in the Great Smokies is the white-flowered variety. A beautiful white-flowered Trillium described recently in scientific literature occurs in the area.

A Yellow Trillium (*Trillium luteum*) occurs frequently on wooded slopes and in sandy coves in the Park. Its bright yellow petals and subtle lemon-verbena fragrance make it most attractive. The White Wake-robin (*Trillium grandiflorum*) is truly grand! Its range is smaller than that of the other white-flowered forms named (*viz., T. erectum* var. *album* and *T. undulatum*). Its large white flowers, which become pale-pink with age, make one estimate it to be among the handsomest of the lot. Some of the mountain folk call it "Sugar Knabs." Huger's Trillium (*Trillium Hugeri*)—a close relative of the yellow-petaled *Trillium luteum,* but seemingly a good species—blooms and disappears early in the spring. It has been found at lower elevations in the western part of the Park.

Many another member of the Lily Family grows in our area. For example, some of the true Lilies (*Lilium* sp.), Lily-royal (*Lilium superbum*), not royal purple in color, but none the less striking, and surely superb in size and stature, grows in grassy openings and on mountain-top meadows in the Great Smokies. The writer has seen specimens up to eight feet tall! The equally handsome Turk's Cap Lily (*Lilium carolinianum*) is a denison of our mountain province. The Trout Lily or Amberbell (*Erythronum americanum*), said to be "rare Southward," is in fact abundant in places in the mountains. The Balsam-bell (*Clintonia borealis*), a truly boreal form, is abundant on the floor of the spruce-fir forests which clothe the mountain tops of the Great Smokies. Its blue berries attract one's attention in late summer and fall. Globe-amoret (*Clintonia umbellata*), of close kin, is common in the moist, rich, cool soil of coves lower down on the mountains. So, too, is Ramps or Wild Leeks (*Allium tricoccum*), much sought and used by mountain people as a spring tonic.

Other worthy Monocotyledons in the area are: the Lily Leaf Sedge (*Cymophyllus Fraseri*), which has every appearance of being a "living fossil"; Sweet-flag (*Acorus calamus*); the Star-Grass (*Hypoxis hirsuta*); and the Blue-eyed Grasses (*Sisyrynchium* sp.) which are not grasses at all; and two Irises (*Iris cristata* and *Iris verna*) are quite common. Highest and last of the Monocots, but more sought-after than any of the others are the Orchids. None are more alluring than the Moccasin-flower (*Cypripedium*) of which we have at least three species in the Park, namely: *C. parviflorum, C. pubescens,* and *C. acaule.* The elusive Showy Orchid (*Orchids spectabilis*) occurs

here too, and a couple of the Fringed Orchids (*Habenaria*) are frequent in the woods in summer: (*H. ciliaris* and *H. psycodes*). The Pearl Twists are well represented by *Spiranthes Beckii* and *Spiranthes cernum;* the Rattlesnake Plantain by *Epipactis repens;* and the Adder's Mouths by the tiny-flowered *Malaxis unifolia.* Adam and Eve (*Aplectrum hyemale*) is common but not conspicuous, while a couple of the Coral-roots (*Corallorrhiza*) are common.

Even yet we have not mentioned the Grasses—economically the most important of all plant communities. Of them we have a large and representative number—some not well known, like the recently discovered *Glyceria nubeigena* and *Agrostis Cainii,* found only on the mountain tops of the Great Smokies. But grasses, chiefly the Mountain Oat-Grass (*Danthonia compressa*), are the dominant plants of the intriguing and justly famous grassy balds of the Great Smokies and other mountains of the Southern Appalachians.

A considerable number of Dicotyls have been mentioned in some of the paragraphs above. All but a few of the trees and shrubs in the Park belong in this category and, despite what has been said, some of the finest gems in the wildflower world. Their number is legion, but one may add to the list only the names of a few, most famous for one reason or another: Starry Campion (*Silene stellata*), doll's eyes (*Actea alba*), wild monkshood (*Aconitum uncinatum*), false bugbane (*Trautvetteria carolinensis*), umbrella leaf (*Diphyllea cymosa*), Dutchman's breeches (*Dicentra cucullaria*), climbing fumitory (*Adlumia fungosa*), squirrel corn (*Dicentra canadensis*), bleeding heart (*Dicentra eximia*), sundew (*Drosera rotundifolia*), brook parnassia (*Parnassia asarifolia*), witch hazel (*Hamamelis virginiana*), blackberries, raspberries (*Rubus* sp.), including the flowering raspberry (*Rubus odoratus*) and the recently discovered blackberry (*Rubus tennesseanus*), wood shamrock (*Oxalis montana*), fringed Polygala (*Polygala paucifolia*), hearts-a-bustin' (*Euonymous americanus*), mountain Saint Johnswort (*Hypericum graveolens*), mountain Stuartia (*Stuartia pentagyna*), meadow beauty (*Rhexia virginica*), ginseng (*Panax quinquefolia*), cow-parsnip (*Heracleum lanatum*), pine-saps (*Hypopitys americana*), galax (*Galax aphylla*), Indian pink (*Spigelia marylandica*), closed gentian (*Gentiana saponaria*), fringed phacelia (*Phacelia fimbriata*), blue phlox (*Phlox divaricata*), creeping phlox (*Phlox stolonifera*), Clingman's hedge-nettle (*Stachys Clingmanii*), Oswego tea (*Monarda didyma*), monkey-flower (*Mimulus ringens*), turtle heads (*Chelone glabra* and *Chelone Lyonii*), yellow fox-gloves (*Aureolaria pectinata* and *Aureolaria flava*), Indian paintbrush (*Castilleja coccinea*), bluets (*Houstonia caerulea, H. serpyllifolia* and *H. purpurea*), witch-hobble (*Viburnum latanoides*), bush honeysuckle (*Diervilla sessilifolia*), ginger root (*Asarum arifolia* and *Asarum canadensis*), golden aster (*Chrysopsis mariana*), golden-rods (*Solidago glomerata, S. odorata, S. caesia, S. Curtisii* and others), asters (*Aster acuminatus, A. Curtisii, A. ericoides,*

and many others), ragworts (*Senecio aureus, S. Smallii,* and the endemic *Senecio Rugelia,* as well as others), and blue lettuce (*Mulgidium villosum.*)

FERNS

To the best of our information some 52 different species of true ferns are indigenous to the state of Tennessee. Of these 32 have been collected in the Great Smokies area. A majority of them are quite abundant and occur more or less widely distributed in the Park. In the spruce-fir forest zone the Mountain Woodfern (*Dryopteris campyloptera*) is one of the most common and conspicuous. On damp rocks and bluffs at middle elevations the Mountain Spleenwort (*Asplenium montanum*) is comparatively frequent but not conspicuous because of its small size. On the forest-floor at lower elevations the evergreen Christmas Fern (*Polystichum acrostichoides*) is quite common. The Hay-scented Fern (*Dennstaedtia punctilobula*) is abundant on banks and along roads and trails up to about 4,000 feet. The beautiful Maiden-hair fern (*Adiantum pedatum*) is widely distributed in damp wooded glades at lower elevations. The following are rare in our area: the Climbing fern (*Lygodium palmatum*), of known occurrence at only four stations in the Park; the little Filmy fern (*Trichomanes Petersii*), discovered growing in only four places in our area,—all on the Tennessee side of the Park. At least two others are even more rare, the Narrow Beech-fern (*Phegopteris polypodiodes*) having been found on Mt. LeConte, and the elusive Filmy-fern (*Trichomanes Boschianum*), discovered recently (March, 1939) in the Park region at the stations along the Little Tennessee River between Calderwood, Tennessee, and Cheoa, North Carolina.

The occurrence in the Park of the following Tennessee and North Carolina ferns is not likely; Adder's Tongue Fern (*Ophioglossum Engelmanii*), Maidenhair (*Adiantum Capillus-veneris*), Crested shield fern (*Thelypteris cristata*), and Hart's tongue (*Phyllitis Scolopendium*).

FERN ALLIES

Thirteen species belonging to this complex have been found growing in Tennessee, only four or five of which are of known occurrence in the Great Smokies area. None of the Equisetums found in areas near the Park have been turned up, though one or two of them may possibly be discovered.

Of the Great Club-mosses (species of *Lycopodium*), some eight have been reported from Tennessee, but only half of them (four) are of known occurrence in the Great Smokies. Of these the Shining Club-moss or "Bear-grass" (*Lycopodium lucidulum*) is most frequently met with occurring in cool, damp woods on the higher mountain slopes where in favorable situations it often forms colonies of considerable size. Ground-pine or Tree Club-moss (*L. obscurum*)

is not infrequently seen in the rich soils of open woods. Its spreading green branches and brown cones give it an appearance strikingly like that of a much dwarfed pine tree. The Running Dwarf-pine (*L. clavatum*) is quite rare with us. It was discovered and added to our lists in 1937, the only known station being along the Appalachian Trail near Inadu Knob, at about 5,000 feet elevation.

The Lesser Club-mosses (species of *Selaginella*) are poorly represented here, only one (*Selaginella apoda*) having been found as yet—in a wet meadow in Cades Cove. It "must" occur elsewhere in our area.

What may prove to be the Quillwort (*Isoetes Engelmani*) was taken at single station in the Oliver Meadow in Cades Cove in 1936. This is the only species of Quillwort known to grow in eastern Tennessee.

ALGAE

Practically nothing is known of the kinds and numbers of Algae which occur in the waters of the Park. We have seen *Spirogyra, Cladophora, Draparanaldia,* and others of the Chlorophyceae. Undoubtedly this Class includes a majority of the species indigenous here. A few Blue Greens have been found. Possibly a representative or two of the Red Algae may occur in the environs, but the likelihood is not great because so much time has passed since our mountains were islands in a great salt water sea. The more cosmopolitan Blue Greens and Greens are present and abundant. Their importance as food for fish and other aquatic animals is known to be great. They are important elements of the biota of aquatic situations, and so these plants are economically important. Their collection and study awaits only time and the man.

SLIME MOULDS

L. M. Cooley (formerly Instructor at the University of Tennessee) in *Myxomycetes of Eastern Tennessee,* 1929, listed 63 species in 11 families, a majority of which were collected in the Great Smokies and general vicinity. (His collections were destroyed in the Morrill Hall fire, University of Tennessee). This work must be regarded as preliminary only. Probably a majority of the Slime Moulds of Eastern North America occur in the Great Smokies, and it would be surprising if the avid collector specializing in this group did not find some new things. The group is not only interesting, but biologically important, and should be worked extensively.

FUNGI

A host of mushrooms and their kin occur during the growing season, and in winter too—white ones, yellow ones, red ones, brown ones, black ones—yes, all colors except *true* green are represented; "big

uns" that weigh fifteen to twenty-five pounds; "little uns" that melt to nothing in no time; mushrooms large enough to shelter a whole family of toads; mushrooms dainty enough to satisfy the most fastidious of Grimm's Fairies. Yes, mushrooms for all!

Due to the concerted efforts of Dr. L. R. Hesler, of the University of Tennessee, and others, the true Fungi of the Park have been extensively collected and studied. In fact, this group of people has contributed practically all we know at present about the Fungi of the area. They have prepared several papers, some of which have been published, while others are available only as special reports or as theses on file at The University of Tennessee.

The total number of true Fungi known to us to have been taken in the Park as of March, 1939, is over 900. Practically all of these are represented by specimens at the University of Tennessee herbarium. (In November, 1935, Dr. Hesler reported on 580 different species. In one year he collected and added 220 more to that number, bringing the total up to 800.) It is believed that 900 is less than half the total number of fungous species in the Park. Thus it will be seen that there is much left to be done in this field of endeavor.

Most of the fungous collections to date are from among the higher, more conspicuous forms.

Significant items of interest about the Park fungi: (1) there are several species hitherto unknown to science, (2) several others were found which previously have been known only in other distant parts of this continent.

LICHENS

Lichen species are common and abundant in the Park area. The casual observer may see them on every hand. All three of the common types, *viz.,* fruticose, foliose and crustose abound. Species of *Usnea* are frequently met with in the spruce-fir forests, the candlestick lichen seems to be everywhere, and nigger-scalps (*Gyrophora*) of large size are frequently seen.

Few collections have been made and preserved. A considerable number of species were on hand and being worked up prior to 1932. Both the exsiccatae and the records were destroyed in the Morrill Hall fire.

A study of this interesting group of plants holds much in store for the investigator.

MOSSES AND LIVERWORTS

The Bryophytes of the Great Smoky Mountains National Park have been extensively collected and studied by Dr. A. J. Sharp of the University of Tennessee. The area has an extraordinarily large variety of these plants. They appear to best advantage in the winter

and early spring, when other forms are less conspicuous for one reason or another, and when they are better exposed to light and to view.

Our mountain slopes are covered with ground pines and mosses, comparatively small and inconspicuous plants now, but representatives and relatives of the forms that constituted the dominant vegetation in ages gone, when the world was younger. No one knows how many different kinds of mosses may be found here. Practically all the common ones, and many of the uncommon ones, too, occur on every hand, in beds impressive because of their size and knee-deep depth. Not all "mosses" are Mosses to the botanist. He finds many of the truly aquatic Algae growing attached to rocks and other objects in the creeks and rivers.

Bryophyta and Sharp are almost synonymous names to us. Dr. Sharp[1] is of the opinion that no area of equal size in the United States—unless there is one in the Pacific Northwest—contains as many species of Bryophytes. He notes that several of the species at higher elevations also occur in northwestern United States.

In a report prepared by Dr. Sharp, 342 species are listed, of which 108 are Liverworts and 234 Mosses. All of them have been found on the Tennessee side of the Park, and some in North Carolina. Bryological exploration on the North Carolina side has not been extensive. It is believed that 95 per cent of the species in the list, plus some not included, occur on the North Carolina side. A few of the Bryophytes of the Park collected by Sharp have not been reported from stations nearer than Arizona, Wyoming, and other states of the intermountain region of the West; and at least two of the species reported in his preliminary list are new to science.

We are prone to think of the Liverworts and Mosses as having little economic value. Perhaps it were better to say commercial value, for there is no doubt that these plants play a very important role in the wildlife picture. Nor can their aesthetic value be denied. It is a matter of common observation that these plants are of great importance in checking soil erosion by water and wind. The protonemata of certain mosses soon overgrow the mineral soil of freshly cut and filled slopes, making a covering which "sheds water like a duck's back." Soon the sporophytes develop, and presently a natural biotic succession area is established in which one plant community after another succeeds until a climax (or a calamity) occurs. The water-absorbing and holding capacity of mosses is remarkable, as is also their capacity to survive adverse conditions. The rapidity with which certain species absorb moisture is comparable to that of a good blotter, and of course this capacity to absorb water quickly is of great importance in reducing damage that accrues from over-rapid run-off. Were it not for the great water-holding capacity of some of the mosses

[1]Sharp, A. J. 1936. Interesting Bryophytes of the Southern Appalachians, *Journal of the Southern Appalachian Botanical Club,* 1 : 49-59.

indigenous at high elevations in the Great Smokies, irreparable damage to the forest cover, as well as other plant and animal life, would occur in seasons of drought—particularly such an extended one as we experienced in the summer of 1936. The mosses which cover the floor of the spruce-fir forest are all important to the well-being of the trees, and vice versa. Brinkman and Cajander suggest that Bryophytes may be regarded as reliable indicators of forest types and so we might go on to show that these plants are (rather than, are not) of economic importance.